Ranaviruses in European Amphibians

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Outline

- Accounts of Ranavirus Infections by Species
  - Urodeles/Caudates
  - Anurans
- Concluding Remarks
- Future Directions
- Ranavirus Reporting System

Common or Smooth Newts

Triturus vulgaris (now Lissotriton vulgaris)

Where: England, UK (Duffus 2010)

Life History Stage: Adult

→ Newt not visibly diseased, but RV infection detected

→ Visibly diseased common frogs present

→ Site long known for M&M in common frogs

Alpine Newt

Mesotriton alpestris cyreni

Where: Spanish Pyrenees (Balsiero et al. 2010)

Life History Stage: Larvae

→ Common midwife toad virus (CMTV)

→ Symptomatic

→ Found in association with an M&M event in common midwife toad tadpoles

Common Midwife Toads

Alytes obsterticans

Where: Spanish Pyrenees (Balsiero et al. 2009; 2010)

Life History Stage: Larvae

→ Common midwife toad virus (CMTV)

→ 1st RV-associated M&M event on main land EUR

Common Midwife Toad

Alytes obsterticans

Where: England, UK (Duffus 2010)

Life History Stage: Adult

→ FV3 – like virus

→ From a pond with a massive multispecies RV M&M event

→ First RV infection in UK in a common midwife toad

Edible Frog

Pelophylax esculentus

Where: Croatia (Fijan et al. 1991); Denmark (Ariel et al. 2009)

Life History Stage: Adult

→ FV3 – like virus ?

→ ≈ 1200 dead adults

→ Many species of amphibians present, but only the edible frogs were affected

Common Toad

Bufo bufo

Where: England, UK (Hyatt et al. 2000; Duffus 2010)

Life History Stage: Adult

→ FV3 – like virus

→ Similar to what is found in common frogs

→ Possibly due to pathogen spill over from frogs

→ Tadpoles are susceptible (Experimental Infections)

Common Frog

Rana temporaria

Where: England, UK (Drury at al. 1993, Cunningham et al. 1996, Hyatt et al. 2000; Duffus 2010)

Life History Stage: Adult

→ First species with RV associated M&M events

→ Described as a 'poxvirus-like' infection, the identified as an iridovirus

→ Tadpoles are susceptible (Experimental Infections)

Ulcerative Form

Ulcerative – Hemorrhagic Form

Fig. 2. A) Male common frog (*Rana temporaria*) with a large amount of subcutaneous oedema in the thorax and femoral area of the lower limbs. B) Common frog with two large ulcerations of the skin of the ventral thorax caused by ranavirus infection.

From: Duffus and Cunningham (2010)

Hemorrhagic Form

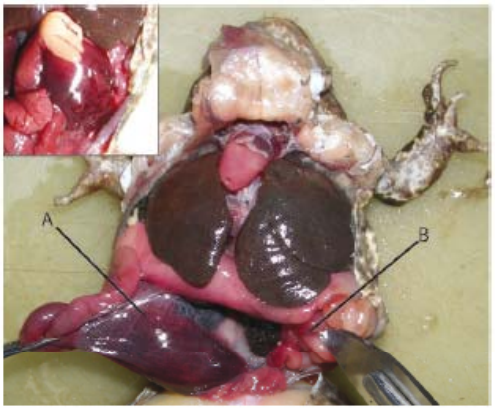

Fig. 1. A common frog (*Rana temporaria*) suffering from ranaviral disease. This frog is an adult female. A) Haemorrhages in the gastrointestinal tract, here most notably affecting the rectum. B) Haemorrhages in the oviducts. In males, the testes can be haemorrhagic (inset; note the apparently healthy fat bodies above the testis).

From: Duffus and Cunningham (2010)

RV M&M Events: Summary

Urodeles:

- To date infections only found in conjunction with anuran species

Anurans:

- Ranids: Infections prevalent in adults
- Other species infection statuses remain mostly uninvestigated

- Limited Screening for RVs
- Poor investigations in general for M&M events

Summary of amphibian species and European countries that have reported ranavirus infections in wild amphibians. (Adapted from Duffus and Cunningham 2010. List current as of May 2011)

Location	***Common Name***	***Species***	***Reference***
UK	Common Frog	*Rana temporaria*	Cunningham *et al.* 1993
	Common Toad	*Bufo bufo*	Hyatt *et al.* 2000
	Common Midwife Toad	*Alytes obstericans*	Duffus 2010
	Smooth (or Common) Newt	*Lissotriton vulgaris*	
Croatia	Edible Frog	*Rana esculenta*	Fijan *et al*. 1991; OIE 2007
Denmark	Edible Frog	*Pelophylax esculentus* (Formerly *Rana esculenta*)	Ariel *et al*. 2009
The Netherlands	Marsh Frog	*Rana ridibunda*	OIE 2011
Spain	Common Midwife Toad	*Alytes obstericans*	Balseiro et al. 2009 & 2010
	Alpine Newt	*Ichthyosaura alpestris* (Formerly *Mesotriton alpestris cyreni*)	

Future Research Directions/Needs

- Increased disease surveillance with statistically valid sample sizes
- Better investigations into morbidity and mortality events that include biologists AND veterinary professionals
- We need to start performing statistically relevant experiments to:
  - Understand species and stage specificity of infection
  - Strain-species interactions
  - Understanding disease progression
- Testing multiple species and life history stages whenever possible

Ranavirus Reporting System

- Online resource
- Built in partnership with US Forest Service and Imperial College
- Looking for input from potential users on how to make the site both informative and user-friendly
- Can email aduffus@gdn.edu with suggestions